



▲ **Reintroduced to Point Reyes National Seashore** in 1978, a herd of 10 tule elk increased to more than 500 in 20 years. The species has been restricted to a fenced reserve on Tomales Point, but in 1999, 45 elk will be released to roam 18,000 acres of park wilderness.

RESOURCE RESTORATION

If parks are to be complete, then damaged or extirpated natural resources must be restored. Without all the organisms and the chemical and geophysical components that define a place and their myriad interrelationships with each other, parks would not be truly representative of whole, naturally functioning ecosystems. The stories presented here tell of ecological restoration of wildlife species, wetlands, and watersheds through the use of state-of-the-art techniques and indicate many successes in this exciting area of resource stewardship. Much of the progress comes from the ability of park staff to integrate several technical disciplines and scientifically apply them to restoration activities. Also important are planning and flexible funding for projects whose duration and complexity may be uncertain. How much work is left to do? Because of fragmented natural systems and resource disturbances, ecological restoration will probably always be part of the natural resource management program in national parks. These activities are a positive force in the quest to sustain park ecosystems.

Wildlife

▶ ENDEMIC TULE ELK TO RANGE FREELY AT POINT REYES NATIONAL SEASHORE

by Thomas Kucera

+ thomas_kucera@nps.gov
Wildlife Biologist, Point Reyes National Seashore,
California

The tule elk, a subspecies of elk endemic to California, was the dominant grazer of central and coastal California for thousands of years. Market hunting and habitat loss following the gold rush nearly drove the tule elk to extinction. The several thousand in existence today all descend from a few survivors protected in the 1870s. After an absence of nearly 130 years, 10 tule elk were reintroduced to Point Reyes National Seashore in 1978, where they were contained in a 2,600-acre, fenced reserve at Tomales Point. The population now exceeds 500. This rapid population growth on a limited reserve alerted the public, state agencies, and park staff to potential resource damage, including impacts on rare plants and an endangered butterfly, and elk die-offs due to overpopulation.

Several scientific review panels and the Tule Elk Management Plan, finalized in May 1998, recommended that a free-ranging herd of tule elk be established at Point Reyes. In early December 1998, park staff, cooperators, and contractors captured 45 tule elk at Tomales Point, attached radio collars, and moved the animals to a temporary holding facility for acclimation and disease testing. They will be released after three months to become a free-ranging herd in an 18,000-acre wilderness area at Point Reyes National Seashore.



To reduce the possibility of elk leaving the park and causing agricultural and other damage, Point Reyes National Seashore staff selected a new range that would be as attractive as possible to the elk. This range is a recently burned wilderness that has been free of livestock for more than 20 years and is isolated by a steep, densely forested ridge that rises over 1,000 feet. All animals carry radio collars, and close monitoring by field personnel for the next several years will allow early detection of trouble.

Soon visitors will be able to see tule elk grazing on native range behind no fences, somewhat as Sir Francis Drake described 500 years ago: "infinite was the company of very large and fat Deere, which there we saw by thousands as we supposed in a herd." The restoration of free-ranging tule elk to the coastal ecosystem will leave only one large mammalian component missing: the grizzly bear. That restoration, however, is unlikely to happen anytime soon.

▶ **The free-ranging elk** will wear radio collars, allowing staff to closely monitor their movements.



For the fourth year in a row, Canon U.S.A., Inc., donated \$1 million in cash and equipment to parks through the National Park Foundation to support biological research and resource management. During the year, this program, called "Expedition Into the Parks," funded 17 projects in 16 parks. In Denali National Park and Preserve, staff conducted an intensive, data-rich survey of grizzly and black bear habitats using Geographic Information Systems and Global Positioning Systems. This information will help direct recreational planning in the area of the park south of the Alaska Range.

Carrying black-footed ferrets in backpacks, resource managers hike into the Badlands wilderness, the release site for the restoration program. In just five years the program has succeeded in establishing a wild population of the black-footed ferret in the South Dakota park.



Curious and alert, a nocturnal black-footed ferret pops out of its burrow in a prairie dog town. The ferret relies on the prairie dog as both its principal food source and its landlord.

SEA TURTLE NUMBERS UP

For the fourth consecutive year, Kemp's ridley sea turtles nested in greater numbers than before along the south Texas coast on or near Padre Island National Seashore. Altogether, 13 nests were documented in 1998, with 4 belonging to individuals from the turtle recovery project, which was launched in 1978 to help the endangered species establish new nesting colonies. In addition to Kemp's ridley nests, 5 nests belonging to green sea turtles, 2 to loggerheads, and 1 to a hawksbill turtle were documented by staff of the Biological Resources Division and the park.



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Threatened and Endangered Species GREAT EXPECTATIONS FOR THE BLACK-FOOTED FERRET AT BADLANDS GPRA

by Glenn E. Plumb, Ph.D., and Bruce Bessken

+ glenn_plumb@nps.gov
Wildlife Biologist, Badlands National Park, South Dakota

+ bruce_bessken@nps.gov
Chief of Resource Management, Badlands National Park, South Dakota

During summer and fall 1998, members of the interagency South Dakota Black-footed Ferret Implementation Team were among the happiest people you may ever encounter in a prairie dog colony at midnight. Not since 1985, when the last known thriving, wild, free-ranging population of the nocturnal black-footed ferret was observed at Meeteetse, Wyoming, have 24 wild-born litters with more than 50 kits and a minimum count of 65 adults been witnessed in one population. The black-footed ferret habitat provided by the black-tailed prairie dog colony complex of Badlands National Park and Buffalo Gap National Grassland in southwestern South Dakota now supports the largest wild black-footed ferret population in the world.

Since 1994, captive-bred black-footed ferrets have been regularly reintroduced into Badlands National Park in order to acquire new and reliable information about how to conduct cost-efficient black-footed ferret reintroduction operations. Five years of restoration efforts have resulted in a high degree of captive-bred black-footed ferret survivorship and

the establishment of a wild population. In order to achieve these goals, the recovery team invoked a broad recovery program philosophy of adaptive management.

Adaptive management involves regular assessment and revision of management techniques based on field observations. In the black-footed ferret recovery program, biologists conducted annual testing of field techniques and, based on what was working, adopted or abandoned certain reintroduction techniques. Through this adaptive management system, the team developed a reintroduction program that increased short-term survivorship of captive-bred black-footed ferrets at 30–60 days after release from 25% in 1994 to approximately 80% by 1997. Indeed, the program has been so successful that black-footed ferret reintroduction programs in Montana, Arizona, and Colorado are using techniques developed in South Dakota.

The current level of success enjoyed by the South Dakota black-footed ferret project clearly demonstrates the utility of NPS Natural Resource Preservation Program (NRPP) funding. With two cycles of NRPP project funding (1993–98) and an adaptive management framework, captive-bred black-footed ferret survivorship greatly increased while the per capita cost of black-footed ferret release and population monitoring decreased. Thus, the park is now poised to shift into a long-term black-footed ferret population recovery program with base funding.



Volunteers Holly Sorensen and Tom Ford

erect a fence and string monofilament line over a plover nest to thwart predators such as gulls, crows, and raccoons. This strategy, plus human-use restrictions of some beaches during nesting season, appears to be contributing to a statewide increase in nesting plovers.

PIPING PLOVER ON THE INCREASE AT SLEEPING BEAR DUNES GPRA

by Max W. Holden

+ max_holden@nps.gov
Park Ranger, Sleeping Bear Dunes National Lakeshore,
Michigan

In 1998, 5 of the 24 nests of the endangered piping plover found in Michigan were located in Sleeping Bear Dunes National Lakeshore. In 1997, 5 of 23 nests were found in the park. Park staff attribute this high percentage of park nests to a recovery program that includes exclosure fences, beach closures, information programs, and volunteers.

In the 1920s the piping plover population in Michigan was estimated to be more than 200 nesting pairs. Because of loss of habitat, this number has declined drastically. The birds nest and feed on wide sandy beaches and are easily disturbed. The proliferation of residential home site development, all-terrain vehicles, dogs, and predators (including crows, gulls, and raccoons) have disturbed the quiet beach areas of the Great Lakes. Similar losses of habitat have occurred in Atlantic Coast nesting and wintering areas on beaches in Florida, resulting in a drop in plover nests and population. In 1986 the Great Lakes and Atlantic Coast piping plover populations were added to the Michigan and federal lists of endangered species. Since 1986 the breeding pairs in Michigan have increased from 12 to 24 pairs.

Beginning in 1986, Sleeping Bear Dunes National Lakeshore began management to protect the piping plover nests. Each spring, all the suitable nesting beaches in the park are searched for breeding piping plovers. The beaches at Dimmick's Point on

North Manitou Island have been closed to public use each year from 1 May to 15 August since the piping plover was listed as endangered.

When pairs in breeding behavior are located, they are closely watched to determine if they nest and to locate the nest. Since 1989, as soon as a clutch is complete with four eggs, a fence has been erected around the nest to exclude predators. The nest is then monitored until hatching and the chicks are monitored until fledging.

In 1997 and 1998 the park had two nesting piping plover pairs at Platte Point, the most popular swimming beach in the park. The park closed a portion of this beach to protect the plovers, which affected public use of the beach. To mitigate this user impact, resource management staff and volunteers were stationed at the point to protect the birds from disturbance and to explain the delicate habitat conditions to visitors. The staff set up spotting scopes and invited approaching visitors to view the birds from a safe distance outside the closed area. At the same time, the visitors heard a discussion about the fragile nature of the piping plover, the importance of protecting its habitat, and other endangered species. In the first year that part of this beach was closed, park staff heard complaints from people unwilling to share the beach with an endangered species. But because staff and volunteers talked with so many beach users in 1997 and received good newspaper and television coverage, the public was more accepting in the second year. Three chicks from each of these two nests fledged on this very busy beach.



The endangered piping plover has increased in Michigan over the past 13 years. With just 12 nesting pairs documented in Michigan in 1986, Sleeping Bear Dunes National Lakeshore began a nest protection program and by 1998 reported 5 of the state's 24 nesting pairs.

Unrecorded at Assateague Island National Seashore (Maryland) for the last 32 years, the threatened sea amaranth was rediscovered on an open beach in summer 1998 by a park wildlife technician. Before the find, the plant species was known to occur only on Long Island and in the Carolinas. An annual, it sprouts only from seed, presumably transported by the ocean, and is considered an indicator of unimpaired natural shoreline processes. Only two plants were found at the park, and both were threatened by Hurricane Bonnie in August as they were beginning to fruit. With great potential to restore the species to the mid-Atlantic, one plant was removed to a greenhouse, where it thrived, producing hundreds of seeds. The other plant was inundated and died.



Wetlands

► HATCHES HARBOR: PROGRESS ON RESTORING A SALT MARSH GPRA

by Norm Farris

+ charles_farris@nps.gov
Ecologist, Cape Cod National Seashore, Massachusetts

In fall 1998, Cape Cod National Seashore and the town of Provincetown, Massachusetts, began work on the largest saltmarsh restoration in the history of the state. The 90-acre restoration project, located between the Hatches Harbor Dike and the Provincetown Airport, requires collaboration among the National Park Service, Provincetown officials, and the Federal Aviation Administration. When completed, the salt marsh will provide increased habitat for saltmarsh plants and animals and provide the airport with additional protection from storm surges.

Many aspects of this project, including environmental permitting, have required a joint town and seashore effort.

The National Park Service owns the 200-acre marsh where the project is located; the town leases the dike from the Massachusetts Department of Environmental Management. The roles and responsibilities of the seashore, town, and Federal Aviation Administration were codified in a memorandum of understanding, which establishes a National Park Service/Town Review Committee to review progress and advise project scientists, natural resource managers, and airport managers.

In 1930 almost half of the original 200-acre salt marsh was diked in an unsuccessful attempt to eliminate mosquitoes. The airport was built on the floodplain shortly thereafter. The dike's blockage of tidal flow dewatered and freshened the salt marsh, eliminating habitat for native saltmarsh grasses (*Spartina* spp.), fish, shellfish, and crustaceans. *Spartina* grasses in this area have been largely



◀ **Marsh restoration at Cape Cod** involves constructing an adjustable culvert system in the dike to allow tidal seawater (left side of dike) to slowly reclaim the marsh (right side) over a period of 5–10 years. As a result, native spartina grasses, now seen only on the left (lower profile), will recolonize the area on the right now occupied by common reed.

FATE OF DAMS STILL UNCERTAIN

Congress has appropriated funds (\$29.9 million) for the acquisition of the Elwha River dams in and near Olympic National Park (Washington). However, before the dams can be acquired, the Secretary of the Interior must demonstrate that the additional \$83.3 million (1995 dollars) required to remove the dams and fully restore the Elwha River ecosystem and fishery will be available within two years of acquisition. No funds have yet been appropriated for dam removal and restoration, although the President's FY 2000 budget includes \$12 million for this purpose.

replaced by common reed (*Phragmites australis*). *Phragmites* has reduced the value of the wetland as habitat for young fish and shellfish, and changed water quality. Meanwhile, interruption of regular tidal flushing and predatory fish access allows mosquitoes to breed in abundance.

Restoring the salt marsh will have many benefits. Restoration will increase nursery habitat for commercially important shellfish, crustaceans, and fish, many of which reduce mosquito populations and are prey for larger animals. Productivity will rise for saltmarsh plants as well. In addition, restoration of regular tidal flow will allow the wetland to again grow upward along with rising sea level. This will provide increased storm surge protection for the airport.

To restore the salt marsh, the dike's present 2-foot-diameter culvert will be replaced by four 7-foot-wide by 3-foot-high box culverts with adjustable gates. The new culverts will be opened gradually over several years to

increase tidal range and encourage salt-tolerant spartina to replace more salt-sensitive phragmites. The phased opening also allows project scientists to monitor and control changes to avoid, for example, a sudden die-off of vegetation. A rapid die-off would create open water and mudflats that would attract feeding birds, a safety hazard for the airport. Low (average 2-foot) earthen berms will be constructed around the airport's instrument landing system to maintain a stable water table in this sensitive area.

National Park Service, U.S. Geological Survey, and University of Rhode Island scientists have conducted pre-restoration environmental monitoring since 1997, collecting water chemistry, vegetation, fish, and shellfish. These data establish a base from which to track changes with restored tidal flow. All participants in this ambitious effort expect that knowledge gained at Hatches Harbor will be important to other restoration projects in the state and beyond.

► PARTNERS RESTORE WETLAND IN THE SANTA MONICA MOUNTAINS NRA

by John Tiszler, Jim Benedict, Lisa Edgington,
and Alan Hsu

+ john_tiszler@nps.gov
Plant Ecologist, Santa Monica Mountains National
Recreation Area, California

+ jim_benedict@nps.gov
Ecologist, Santa Monica Mountains National Recreation
Area, California

+ lisa_edgington@nps.gov
Biological Technician, Santa Monica Mountains
National Recreation Area, California

+ ahsu@rb4.swrcb.ca.gov (Alan Hsu)
Sanitary Engineering Associate, Santa Monica Bay
Restoration Project, California

Volunteers for the Zuma Creek wetland restoration planted wiregrass, common tule, California bulrush, bull tule, and broad-leaved cattail within the marsh expansion area. Their efforts enhanced the existing marsh and expanded it ½ acre over its previous size.

In 1998 state and federal agencies, nonprofit organizations, and the public began restoration of a valuable wetland in Santa Monica Mountains National Recreation Area, California. The history of the development and implementation of this project illustrates the unique problems and opportunities associated with restoration in urban areas and the strength of partnerships in accomplishing restoration goals. It also demonstrates that NPS funds are often best spent on the preparation of a technically sound restoration plan, for a completed plan makes the job of attracting non-NPS sources of funding for the restoration itself much easier.

Lower Zuma Creek and Lagoon is a unique freshwater marsh and riparian habitat located on a coastal beach within the authorized boundary of Santa Monica Mountains National Recreation Area. The wetlands and surrounding riparian areas and uplands have been reduced and heavily impacted by long-term dumping of debris and surplus fill. Despite this situation, the site has high potential for successful restoration. The confluence of freshwater marsh, riparian, foredune, coastal sage scrub, and beach communities that will exist after restoration will create an unusually diverse habitat of high value to wildlife.

In fall 1993 the Los Angeles County Sheriff's Department requested that the Los Angeles County Department of Beaches and Harbors, which owns the beach and lagoon at lower Zuma Creek, clear vegetation along the creek and lagoon because they attracted transients and unlawful activity. The County Department of Beaches and Harbors' application to the California Department of Fish and Game for vegetation removal alerted land management agencies to the possible destruction of this valuable wetland habitat.

Representatives from the National Park Service, California Department of Fish and Game, California Department of Parks and Recreation, Santa Monica Mountains Conservancy, Resource Conservation District of the Santa Monica Mountains, and Santa Monica Bay Restoration Project met to discuss the problem. The group decided to restore wetland, riparian, and surrounding upland habitat in a way that would satisfy the sheriff's request for openness and visibility. The National Park Service, Department of Beaches and Harbors, and Bay Restoration Project were assigned the lead for the restoration project. The project includes the creation of ½ acre of freshwater marsh and approximately 2½ acres of dune, willow riparian, sycamore alluvial woodland, and coastal scrub habitat in the existing fill area, with an additional 4½ acres of existing habitat enhanced (see table).

Funding for the restoration comes from the NPS Water Resources Division and an EPA grant. The Los Angeles County Department of Beaches and Harbors



Santa Monica Mountains NRA, Jim Benedict



Santa Monica Mountains NRA, Jim Benedict

provided valuable in-kind services in the form of planning, support, personnel, and equipment. Volunteers from TreePeople and Eco-Heroes also provided in-kind support.

The final restoration plan was completed in April 1997 and work commenced in early April 1998. By the end of 1998, the site work was complete, native plants were planted, nonnative

plants were removed, and interpretive trails were built. The addition of an underground irrigation system ensures the viability of the new plantings. A biological technician, hired for the duration of the project with funds from the Water Resources Division, will monitor and maintain the site.

Table. Native habitat acreage before and after implementation of the lower Zuma Creek and Lagoon restoration project.

Habitat	Acreage	
	Existing	Restored
Dune		
Enhanced	—	1.2
Created	—	0.2
Total Habitat	1.2	1.4
Willow Riparian		
Enhanced	—	2.4
Created	—	0.2
Total Habitat	2.4	2.6
Sycamore Alluvial Woodland/Coastal Scrub	0	1.5
Freshwater Marsh		
Enhanced	—	0.8
Created	—	0.5
Total Habitat	0.8	1.3
Total Acreage (Native Habitat)	4.4 (disturbed)	6.8

Award-Winner Profile FACILITY MANAGER RECOGNIZED

Greg McGuire, facility manager and chief of area services at Fort McHenry National Monument (Maryland), was awarded the first Director's Award for Excellence in Natural Resource Stewardship Through Maintenance. During 1997, Greg developed a creative partnership among volunteers and federal, state, and local governments to clean up and restore a 5-acre, state-owned tidal wetland immediately adjacent to Fort McHenry. Periodic storm surges deposited trash in the tidal wetland, impacting natural resources and the visual experience of fort visitors. Greg viewed the wetlands as a shared resource protection and management challenge, and brought together several entities to carry out the cleanup. He applied for Challenge Cost Share funds to be combined with monies from the State of Maryland to fund the project. As a result of his efforts, the Chesapeake Bay Alliance brokered a partnership between the park and the National Aquarium in Baltimore to conduct research and additional restoration of wetlands within the park.

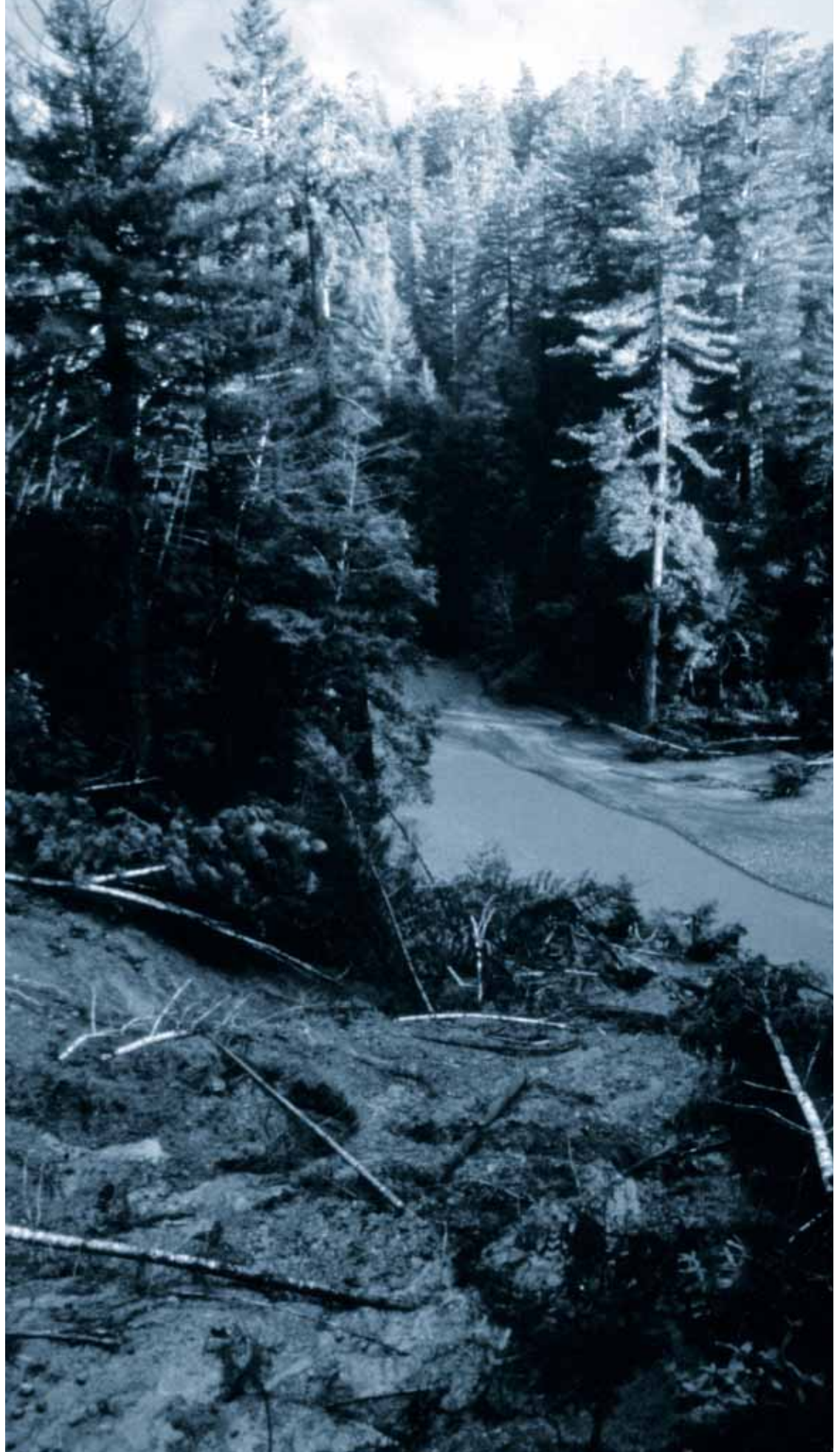


Greg McGuire

Heavy rains from a 1997 New Year's Day storm saturated road fill and resulted in the failure of this hillside into Redwood Creek, just 1/2 mile upstream of the world's tallest tree. Emergency funds are helping the park address the severe erosion problem posed by 155 miles of remaining logging roads.



With needs identified since 1987, the Abandoned Mineral Lands (AML) Program of the National Park Service was approved for base funding in 1998. The funds are awarded to parks for projects designed to address degraded lands and waters and mitigate safety problems related to abandoned mines. The program is administered by the NPS Geologic Resources Division, which supported 21 projects in 17 parks throughout five NPS regions during the year. These projects related to mine site reclamation, mine hazard mitigation, habitat conservation, site characterization, and future project planning. More than 140 park units manage issues related to abandoned mineral lands.





► **Emergency funds** are being used to restore abandoned logging roads, such as this one (left) that crossed a headwater stream in an old-growth redwood forest. The road was excavated down to the original stream channel (middle), restoring the natural slope and hillside hydrology and greatly reducing the threat of erosion. One year after restoration (right), vegetation is aggressively reclaiming the area.

Disturbed Lands

► RELIEF FUNDS EXPEDITE WATERSHED RESTORATION PROGRAM GPRA

by Darci Short

+ darci_short@nps.gov
Geologist, Redwood National Park, California

In 1998, work began on repairing the damage caused to Redwood National and State Parks by the 1997 New Year's Day storm that hit much of northern California. This storm caused extensive damage to roads, trails, and buildings throughout both parks. The greatest damage was caused by landslides or culvert failures along old abandoned logging roads incorporated into the park during the 1978 park expansion. In total, 91 road sites suffered varying degrees of damage, cutting off access to about 30 miles of road segments.

"The storm funding ... add[ed] approximately 10 times the annual funds formerly available for this work."

As a result of the storm damage, Redwood National and State Parks received \$8.99 million as part of the 1997 Natural Disaster Relief Act and \$1.19 million from the Federal Highways Administration Emergency Relief for Federally Owned Roads program. Approximately 80% of the funds are earmarked for removing unneeded road segments isolated by landslides or culvert failures, and 15% for repairing essential park access roads. The remainder is for repairs to damaged trails and buildings.

The parks had already been removing unneeded roads as part of the ongoing watershed restoration program. Since park expansion in 1978, approximately 200 miles of roads have been removed or treated for erosion control. The storm funding supplements the

existing base-funded Redwood Creek watershed restoration program, adding approximately 10 times the annual funds formerly available for this work. Without the supplemental funds, it would take many years to remove these roads. Left untreated, they pose a great threat to park ecosystems and downstream aquatic and riparian resources.

The storm damage came at a time when the national park had just completed an inventory of potential erosion that could result from the 155 miles of park roads that remain in the Redwood Creek watershed. The park had developed a prioritization scheme based on the existing quality of aquatic and riparian ecosystems within the tributary watersheds, the erosion and sedimentation threat from upslope roads, proximity to ancient redwood groves, and the disturbance levels in cultural and scenic landscapes. The 1997 storm "tested" the stability of these roads. The resource damage highlighted the urgency to remove the abandoned logging roads before additional, more serious damage occurs.

The highest-priority area of the park in need of restoration work is the Lost Man Creek watershed. This watershed provides habitat for the threatened coho salmon and two bird species (northern spotted-owl and marbled murrelet) listed as threatened under the Endangered Species Act. Road removal in the Lost Man Creek watershed will allow for more rapid recovery of the heavily logged watershed, providing the best protection for these threatened species and adjacent downstream park resources. Storm damage funds will pay for the removal of 30% of the roads within the Lost Man Creek watershed in the next few years.



The last of 194 buildings in former visitor lodging and employee housing areas was demolished in September, completing one phase of the Giant Forest restoration in Sequoia National Park (California). Ecological restoration began as roads, parking lots, walkways, and building pads were recontoured; compacted soil was loosened; and disturbed soil was protected from erosion with wood chips or soil retention blankets. In October the first 4,570 grass, forb, shrub, and tree seedlings were planted on the site of the Giant Forest Lodge, beginning the revegetation phase in these formerly developed areas beneath the giant sequoia trees.